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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/644,441	08/20/2003	Donald W. Dine	G00352/IUS	7039

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EXAMINER	
BINDA, GREGORY JOHN	

ART UNIT	PAPER NUMBER
3679	

DATE MAILED: 09/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/644,441	DINE ET AL.	
	Examiner	Art Unit	
	Greg Binda	3679	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-7 and 9-23* is/are pending in the application.

4a) Of the above claim(s) *15-19* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-7,9-14 and 20-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 February 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: English language translation of EP 0 441 240 A2

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed September 1, 2005 in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 18, 2005 has been entered.

Election/Restrictions

3. Claims 15-19 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on October 7, 2004.

Specification

4. The title of the invention is objected to because it includes the word "improved". See MPEP § 606.

Claim Rejections - 35 USC § 102

5. Claims 1, 6, 7, 9, 10, 14, 22 & 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Esperson, US 3,286,487. Fig. 1 shows a propeller shaft assembly comprising a

tubular shaft 8 and a connecting member 6 fixed to each end of the tubular member. In col. 2, lines 66-70, Esperson discloses the shaft assembly shown in Fig. 1 could also include a tubular rigid foam plastic support member having a generally uniform outer diameter along its entire length engaging the interior surface of the tubular member.

6. Claims 1, 6, 7, 9, 10, 14, 22 & 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Smiley et al, US 5,397,272 (Smiley). Fig. 6 shows a propeller shaft assembly comprising a tubular shaft 10; a connecting member 12 fixed to each end of the tubular member (see also col. 3, lines 41-43); and a tubular rigid foamed plastic support member 38 having a generally uniform outer diameter along its entire length engaging the interior surface of the tubular member.

7. Claims 1, 2, 5-7, 9, 10, 12-14, 22 & 23 are rejected under 35 U.S.C. 102(b) as being anticipated by McNeely, US 4,560,012. Figs. 1-3 shows a propeller shaft assembly comprising: a tubular metal shaft 32 (see also col. 5, lines 56-60); a connecting member 40, 41 fixed to each end of the tubular member; and a tubular support member 33a having a generally uniform outer diameter along its entire length engaging the interior surface of the tubular member. Figs. 1-3 show the ratio of the length of the support member 33a to the length of the tubular shaft 32 is greater than 0.25 and less than 1.0. In col. 4, lines 9-15, the tubular support member 33a is disclosed as rigid, foamed, cellular and impregnated with resin or cement.

8. Claims 1, 4, 6, 7, 9-11, 14, 22 & 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Schuermann et al, EP 0 471 240 (Schuermann). Schuermann discloses a propeller shaft assembly comprising a reinforced plastic (see "FRP" in the English language description provided by DERWENT) tubular member 1, a joint element 2 fixed to each end of the tubular member, and a tubular support member 6, having a generally uniform outer diameter over its entire length (see page 3, lines 5-8 of the complete English language translation attached to this action) and with a plurality of openings 9, fixed within the tubular member. In the English language description provided by DERWENT the support member is disclosed as being made from foamed plastic. The figure shows the tubular member 1 has a length that is greater than that of the support member 6.

Claim Rejections - 35 USC § 103

9. Claims 2, 5, 12, 13, 20 & 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuermann.

a. Claims 2, 5, 12 & 13. In the English language description provided by DERWENT, Schuermann discloses that the support member is made from foamed plastic, but does not disclose the foam being impregnated with a high modulus resin. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to impregnate the foam of the support member with a high modulus resin in order to provide a means for sound absorption because such a modification is well know in the art. (See Fletmier et al, US 6,156,682 (Fletmier) in col. 1, lines 14-26 where it is disclosed that it is well

known in the art to impregnate foam with a high modulus resin in order to provide a means for sound absorption.)

b. Claims 20 & 21. Schuermann shows an assembly comprising all the limitations of the claims but does not expressly disclose making the tubular member with a thickness generally less than 8 mm and an outer diameter between 40 and 300 mm. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the tubular member with a thickness generally less than 8 mm and an outer diameter between 40 and 300 mm, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056.

10. Claims 2, 5, 12, 13, 20 & 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over any one of Esperson and Smiley for the same reasons noted above.

11. Claims 20 & 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over McNeely for the same reasons noted in item 9b above.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Greg Binda whose telephone number is (571) 272-7077. The examiner can normally be reached on M-F 9:30 am to 7:00 pm with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Daniel P. Stodola can be reached on (571) 272-7087. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Greg Binda
Primary Examiner
Art Unit 3679

PTO 05-1157

CY=DE DATE=19920219 KIND=A2
PN=471 240

ENGLISH LANGUAGE
TRANSLATION
OF
EP 0 471 240 A2

HOLLOW SHAFT OF FIBER-REINFORCED PLASTIC
[HOHLWELLE AUS FASERVERSTÄRKTEM KUNSTSTOFF]

HELMUT SCHUERMANN, et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. December 2004

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INVENTOR	(72):	HELMUT SCHUERMANN and DIETMAR KASPER
APPLICANT	(71):	ELASTOGRAN KUNSTSTOFF-TECHNIK GMBH
TITLE	(54):	HOLLOW SHAFT OF FIBER-REINFORCED PLASTIC
FOREIGN TITLE	[54A]:	HOHLWELLE AUS FASERVERSTÄRKTEM KUNSTSTOFF

The invention relates to a hollow shaft of fiber-reinforced plastic according to the preamble of Claim 1.

Drive shafts of fiber-plastic composites are of interest to the automotive industry in many regards. They have all of the properties that makes them appear to be a reasonable substitute for steel or aluminum shafts. Their special advantages lie in weight savings, freedom from corrosion and better acoustic properties in comparison to metal shafts.

Because of the high ratio of modulus of elasticity to density, higher critical speeds of rotation can be achieved with such shafts than with metal shafts of the same dimensions. This is especially true of shafts made of high-rigidity carbon fibers. The high price of carbon fibers is disadvantageous here, so to date it has not been possible for such shafts to become widespread in practice. Hollow shafts of fiberglass-reinforced plastics are actually more economical, but they hardly achieve higher critical rotational speeds without additional arrangements.

The object of the invention is to improve a hollow shaft of the type defined at the beginning with respect to the critical rotational speed, while taking into account economic considerations.

To achieve this object, measures according to the characterizing section of Claim 1 are suggested.

According to the invention, the critical rotational speed of a hollow shaft and/or drive shaft is increased by increasing the shaft diameter. To do this, the shaft part, having prefabricated connecting

means at its ends, is at least approximately parabolically cambered. In general, only the outer contour of the shaft part is cambered, while the inner shroud surface is designed with a cylindrical shape. In this case, at the point of its largest diameter the shaft part also has its greatest thickness. However, it is also conceivable to design the shaft part with a wall thickness that remains the same over its entire length, i.e. both the inner shroud and the outer shroud are curved appropriately.

It is especially favorable to provide the largest shaft diameter in the center between the connectors, since the greatest bending moment stress acts here due to the centrifugal forces and an increase in the bending stiffness of the shaft has the most effective action on the elevation of the critical rotational speed. It is not absolutely necessary here to change the diameter of the shaft continuously over the length, but it is conceivable that in some locations the shaft will be drawn back in to a smaller diameter, e.g., if there is a danger that projecting parts close to the shaft will be contacted during slight oscillations of the shaft.

The camber is formed by an appropriately-shaped core, which can be mounted directly on a winding mandrel. If necessary, the winding mandrel can be dispensed with if the core is adequately stiff. The fiber composite layers that actually transfer the torsion moments will be applied to the core. However, the core can also be embedded between two fiber composite layers. To do this, first composite fiber layers are applied to a smooth winding mandrel and the core, which

effectively consists of half-shells, is fastened on them. With the subsequent winding of further composite fiber layers, a shaft part is developed that has a clearly increased loading capacity. The improved breaking strengths of such a shaft during thrust load stress and the increase of the torsion buckling limit are especially advantageous since the core acts as a support in the overall assembly. The thickness of the composite fiber layers is designed exclusively for the transfer of torsion moments. An increase in the wall thickness of the shaft part for preventing torsion buckling is superfluous. Since the increase of the critical rotational speed is essentially achieved by increasing the diameter in the center part of the drive shaft, the shaft ends can be adjusted slightly to specific space conditions or to the specified elements for introduction of force without additional transition elements having to be joined between them and the connecting means. The hollow shaft according to the invention is simple to manufacture and material costs can be saved to a considerable extent.

Effective further developments of the hollow shaft according to the invention are the objects of Claims 2 to 6.

In the following, the invention will be explained in more detail using different embodiment examples, with reference to the drawing.

Essentially, the hollow shaft consists of a shaft part (1) of plastic, reinforced with fibers, which has torque-transferring connecting means (2) at both ends. The outer contour of the shaft part is parabolically cambered. The cores forming the camber are indicated

with (3), (4), (5) and (6), of which the cores (3) and (4) are embedded between two fiber layers (7, 8) and the cores (5) and (6) each represent the inner shroud of shaft part (1). The core (6) contains several coaxial grooves (9) arranged adjacent to each other in lengthwise direction, because of which support on the winding mandrel (not shown in the drawing) occurs over only a small area. Because of this, there is an additional weight savings. On the outer shroud surface of the shaft part (1) and/or of the core (4), finally one or more recesses (10) can be provided in uniform spacing around the circumference.

The pipe-shaped shaft part (1) is manufactured according to a known method, in that plastics that can be hardened by radiation or temperature increase or fiber materials impregnated with thermoplastic plastics are wound on a mandrel.

All artificial resins that can be cross-linked due to free radicals can be used as plastics that can be hardened by radiation or temperature increase, e.g., unsaturated polyester resins, vinyl ester resins, modified epoxy resins, modified polyurethane resins or mixtures of these resins. Besides that, mixtures of these resins with unsaturated monomers that can be mixture-polymerized can be successfully used.

Suitable thermoplastics are, e.g., olefin polymerides, like polyethylene or polypropylene, especially aromatic polyether and polythiolether that have good high-temperature dimensional stability and acid resistance, like polyphenylene ether, polysulfone, polyether

sulfone, polyether imide, polyether ketone or polyphenylene sulfide, as well as mixtures of these polymerides.

String-shaped or strip-shaped structures of natural and synthetic organic fibers like aramide, polyamide, polyester fibers and the like, and of inorganic fibers, e.g., glass fibers, carbon fibers, etc. can be considered as fiber materials. The glass fibers are treated with the usual sizing, e.g., a bonding agent based on silane or chromium.

The fiber material is oriented so that it is inclined more or less to the axis of the pipe-shaped shaft part. In general, the winding angle is about ±12° to about ±45°. At these winding angles, adequately high torsion strengths and adequately high longitudinal bending strengths result.

The core preferably consists of a formed plastic, e.g., of a hard foam of polyurethane, a low-melting metal alloy, especially bismuth alloy or a salt.

Patent Claims

1. Hollow shaft of fiber-reinforced plastic, especially drive shaft for motor vehicles, with a pipe-shaped shaft part built up of wound fiber layers and prefabricated connecting means fastened permanently at the ends of the shaft part, characterized in that the pipe-shaped shaft part (1) is at least approximately parabolically cambered, whereby the camber is formed by an appropriately shaped core (3, 4, 5, 6).

2. Hollow shaft according to Claim 1, characterized in that the core (3, 4, 5, 6) consists of foamed plastic, metal alloys that melt

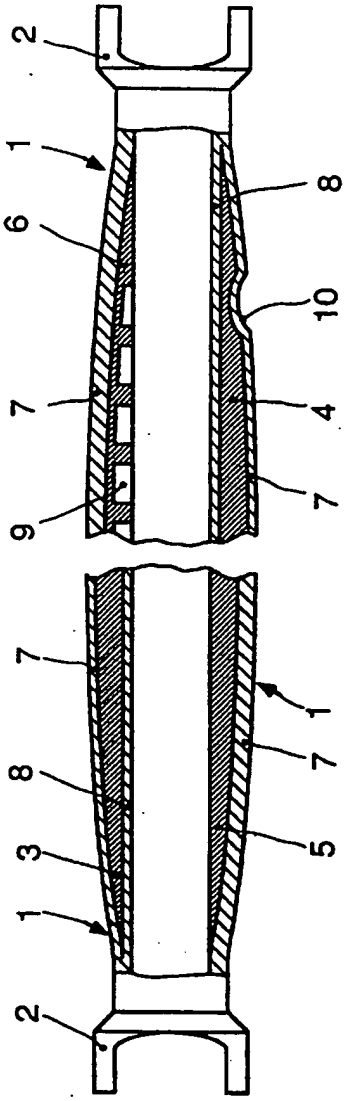
at low temperatures, salts or the like.

3. Hollow shaft according to Claim 1, characterized in that the core (3, 4) is embedded between two fiber layers (7, 8).

4. Hollow shaft according to Claim 1, characterized in that the core (5, 6) forms the inner shroud of the shaft part (1).

5. Hollow shaft according to Claim 1, characterized in that the core (6) has several grooves (9).

6. Hollow shaft according one or more of the preceding claims, characterized in that the outer shroud surface of the shaft part (1) has recesses (10) equally spaced around the circumference.



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